

Claims

1. A multiple stage Raman optical amplifier for amplifying an optical transmission signal within a transmission wavelength band comprising a first amplification stage comprising a first length of Raman-active optical fibre and a first pump source for generating a first pump signal within a first pump wavelength band, said first pump signal being coupled to one end of the first length of Raman-active optical fibre;
- a second amplification stage comprising a second length of a Raman-active optical fibre and a second pump source for generating a second pump signal within a second pump wavelength band different from the first wavelength band, said second pump signal being coupled to a first end of the second length of Raman-active optical fibre and whereby residual pump signal appears at a second end, opposite to the first end, of said second length of fibre;
- a wavelength-selective pump combiner interposed between the first and the second amplification stages adapted for substantially transmitting the optical transmission signal between the first amplification stage and the second amplification stage, the pump combiner including a first port (A) coupled to said one end of the first Raman-active fibre, a second port (B) coupled to the second end of the second Raman-active fibre, a third port (C) coupled to the first pump source, wherein
- the pump combiner is arranged for substantially passing the first pump signal coupled to the third port to the first port and for substantially blocking the passage of the residual pump signal coupled to the second port into the first amplification stage.
2. The multiple stage Raman amplifier of claim 1, wherein the wavelength-selective pump combiner further includes a fourth port (D) and is arranged for substantially passing the residual pump signal of the second pump source to the fourth port.

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3. The multiple stage Raman amplifier of claim 2, further comprising a photodetector optically coupled to the fourth port of the pump combiner for monitoring the residual pump signal of the second pump source.
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4. The multiple stage Raman amplifier of one of the preceding claims, wherein the transmission wavelength band of the optical transmission signal is comprised between 1520 nm and 1630 nm.
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5. The multiple stage Raman amplifier of claim 4, wherein the first pump wavelength band of the first pump signal is comprised between 1415 and 1465 nm and the second wavelength band of the second pump signal is comprised between 1465 and 1520 nm.
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6. The multiple stage Raman amplifier of one of the preceding claims, wherein the pump combiner includes at least a thin film filter adapted to reflect the first and the second wavelength bands of the pump sources.
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7. An optical system comprising an optical transmission line including at least an optical fibre and a multiple stage Raman amplifier of one of the preceding claims.
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8. Method for pumping a multiple stage Raman optical amplifier including a first Raman amplification stage and a second Raman amplification stage, the first and second stage being coupled to each other by an interstage wavelength-selective pump combiner, the method comprising:
- feeding into the first Raman amplification stage a first pump signal with wavelength within a first pump wavelength band;

- feeding into the second Raman amplification stage a second pump signal with wavelength within a second wavelength pump band having no overlap with the first pump wavelength band;
 - reflecting the second pump signal in the pump combiner so as to prevent a residual pump signal from the second Raman amplification stage within the second pump wavelength band from reaching the first Raman amplification stage.
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9. Method of claim 8, wherein feeding of the first pump signal into the first amplification stage is performed by reflecting said first pump signal in the pump combiner.